University of Tartu

Faculty of Social Sciences

Institute of Education

Curriculum of Educational Technology

Brian Lynam

An exploration of the transformative use of Artificial Intelligence as a reflection tool, through the experiences and perspectives of trainee teachers

MA thesis

Supervisor: Prof Emanuel Bardone

Tartu, 2024

An exploration of the transformative use of Artificial Intelligence as a reflection tool, through the experiences and perspectives of trainee teachers

Abstract

This study explores how Artificial Intelligence (AI) can be integrated into the professional development of teachers, with a particular emphasis on improving reflective practice due to various implementation challenges. Reflective practice is central to the growth of educators and this study focused on using AI chatbots to assist trainee teachers in their reflective practice through conducting qualitative interviews and using selected extracts from interaction logs to gather data from participants in an international teacher training program. The results indicate that AI chatbots can significantly enhance reflective practice by offering more personalized feedback and stimulating deeper introspection, which in turn leads to greater critical-awareness, insights and professional development among the participants. The study concludes that AI-driven tools can effectively address the challenges associated with current reflective practice and suggests potential improvements for future development. The findings have important implications for educational policymakers, teacher training institutions, and technology developers, emphasizing the imperative to integrate AI in education in a responsible and ethical manner. Future research would benefit from investigating long-term effects of AI on reflective practice and its potential to support ongoing professional development across diverse educational settings.

Keywords: artificial intelligence, reflective practice, chatbots, transformation

Table of Contents

Chapter 1 - Introduction
1.1 Brief introduction to the chosen topic 4
Chapter 2 - Theoretical Overview 5
2.1 Reflective Practice: Concepts and Challenges 5
2.2 Reflective Practice in Action 8
2.3 Transformative Paradigms 8
2.4 Artificial Intelligence and Technology Acceptance 10
2.5 Theoretical Review Conclusion 12
2.6 Research Gap and Study Contribution 12
2.7 Research Objectives: Purpose, Significance and Key Question 12
Chapter 3 - Methodology 13
3.1 Research Design 13
3.2 Sample Selection 14
3.3 Data Collection Methods 15
3.4 Data Analysis Methods 15
Chapter 4 - Results 16
4.1 Background information 16
4.2 AI's Impact on the Depth and Quality of Reflective Practice 17
4.3 Influence on Critical Reflection and Shifts in Perception 18
4.4 Challenges, Concerns and Barriers of Implementation 20
4.5 AI in Future Professional Development and Transformative Potential 20
Chapter 5 - Discussion 23
5.1 Main Discussion 23
5.2 Implications of the Study 27
5.3 Limitations of the study and future research 27
5.4 Conclusion 28
List of References 28
Author's declaration and Acknowledgement 36
Appendices 37
Non- Exclusive License 39

Chapter 1 – Introduction

1.1 Brief introduction

Artificial Intelligence (AI), saviour and solver of all humanities problems, or a harbinger of doom, this paper focusses on the integration of AI technology into the professional development of teachers, offering a glimpse of its potential role in the future development of educators across the world. The notion of this paper stems from a global landscape that is being swiftly inundated with the latest AI tools and applications, alongside the glaring threat of mass disruption in the labour market and rising levels of industrial automation. Concerns about AI are frequently shared by researchers, policymakers in science and technology, as well as the general public (Zhang and Dafoe, 2019), and these apprehensions have become widespread among industry experts and professionals.

Predicting the development of technology, especially emerging technologies such as advanced AI systems, is inherently difficult. Long-standing goals include achieving human-like 'common sense' or, as Turing (1950) anticipated, creating machines whose intelligent behavior can be compared to that of humans. It is expected that AI can improve proficiency, productivity, and creative endeavours so much so that AI processes "can free humans from repetitive duties while improving the amount of work they can complete" (Khogali & Mekid, 2023).

The World Economic Forum's most recent report highlights four areas where AI will influence education in the coming years: (1) personalized learning content and experiences, (2) refined assessment and decision-making processes, (3) optimization of teacher roles through task augmentation, and (4) integration of AI into the education curricula. The report states that "freeing educators from routine tasks, AI empowers them to focus on building relationships, understanding individual student needs, and fostering motivation" (W.E.F, 2024, p.1). Given the vast potential for AI to directly link the needs and goals of education due to its capability as an emerging technology, and the pervasive claims and potential for societal transformation and disruption that exists, consideration should be given to how the professional development and pedagogical approach of teachers and educators across the world may be impacted by such extensive adoption.

Reflective practice is a major component of developmental learning for new teachers and has long been a key part of pre-service teacher development and assessment, based on theorists such as Schön, Gibbs, and Kolb. Despite its agreed positive impact, problems in its

application in schools abound, with some labeling it meaningless, counterproductive, and a "recipe-following" activity (Boud, 2010), or existing superficially without true engagement from teachers (Mann & Walsh, 2013). Given these challenges and the influx of AI technology available, this paper timely explores the practical and specific application and integration of AI-based reflection tools in the professional setting of trainee international schoolteachers.

Chapter 2 – Theoretical Overview

2.1 Reflective Practice: Concepts and Challenges

Reflective practice in education has its roots in ancient philosophy, such as the Socratic method used for self-examination and inquiry to educate Plato (Barnett, O'Mahony, & Matthews, 2004) and the writings of Marcus Aurelius for self-improvement while on campaign between 170 and 180 AD (Mac Suibhne, 2009). Additionally, precursors of reflective practice can be traced back to ancient Buddhist texts through the concept of Praxis, which involves mindful reflection on one's life (Winter, 2003).

Irrespective of its origins, John Dewey defined reflection as a cognitive process involving "an active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (Dewey & Heath, 1933, p. 9). This suggests that addressing real problems and finding rational solutions are central to reflective practice. Dewey further noted that "we do not learn from experience," but rather "we learn from reflecting on experience" (1916, p. 139).

While Dewey and Schön primarily view reflection as a cognitive activity, other scholars underscore its critical, psychological, and affective components (Boud et al., 1985). In teacher training, reflective practice aims to deepen trainee teachers' learning experiences, increase self-awareness, and facilitate learning from experience. It has become a dynamic, participatory, and cyclical process that significantly influences educators' professional development and personal growth (Ai et al., 2017., Mohamed et al., 2022). Reflective practice is essential for educators to fully understand their motivations, expectations, assumptions, and experiences (Lubbe and Botha, 2020), and presently, it is a key facet of training and induction for trainee teachers, helping them evaluate and refine their practices and develop relevant skills as needed (Childs and Hillier, 2022). The structural importance of this concept in professional teacher development is illustrated in the Norwegian ECTE (Ministry of Education and Research [MER], 2012), which references 'reflection' 23 times

through various concepts such as ‘reflection over ethical questions,’ ‘professional reflection,’ and ‘critical reflection’ (as cited in Moxnes and Osgood, 2018). Nonetheless, in light of the widespread acceptance and adoption of reflective practice, the concept of ‘reflection’ is quite broad, which has led to some disentanglement between reflection the concept and actual reflective practice (Aliakbari and Adibpour, 2018) with the result of muted performance and acumen in practice (Davies, 2012). Some view reflection as merely “just thinking” (e.g., Loughran, 2002, p. 33), while others view it as a formulated and drilled practice with a specific objective, insights, and corresponding action (e.g., Dewey, 1933; Schön, 1983; Grimmett and Erickson, 1988). There are a myriad of definitions and characteristics that are considered reflection, which can make it difficult for many teachers to fully grasp the concept, leading to a lack of effective engagement in professional development (Huynh, 2022; Knassmüller, 2022). Some examples of this include education teachers who perceive reflective practice to be antithetical to real and practical learning (Guillaumier, 2016; Georgii, Hemming et al., 2020) as they often view it as reflective writing that is assessed and “disconnected from the embodied and non-verbal dimensions of making and reflecting on art” (Treacy & Gaunt, 2021, p. 488). Other problems abound, such as issues about real-world applications involving the fear, stress, and uncertainty endured by teachers (Harscher et al., 2004), which is seen cross-culturally (Nguyen, 2010), the time-consuming process and effort required to produce quality reflection (Finlay, 2008) and the bleak reality that reflection often becomes ineffective due to students being fixated on satisfying the assessment purposes of a program or supervisor (Hobbs, 2007).

Another main contention of reflection practice is that while there are many theories and methods of reflection, such as Gibbs’ Reflective Cycle (1988) or Korthagen’s Onion model (2004), each model is liable to misapplication or contextual ill-fitting with Fendler (2003, 20) expressing this as a “catch-all term” littered with “mixed messages and confusing agendas”. Given the wide array of reflective options available to students, another issue is the extent to which reflecting is mandated on professional training and courses (Boud and Walker, 1998) with little agency afforded for those students towards whom reflective practice may not be suitable or desirable (Quinn, 2000). Therefore, there may be a need for more personalized reflective experience for students, or the adoption of alternative technologies to foster reflection. A review on the state reflection in teacher education posed the question whether it was now time to switch focus from reflection as a required tool, to the actual concept itself, and explore more profoundly its meaning and role for enhancing professional practice in diverse contexts (Beauchamp, 2015).

2.2 *Reflective Practice in Action*

Despite the evolving landscape of education, engagement in reflective practice remains a key component towards becoming a competent professional, enabling educators to evaluate, stimulate, and critically reflect on their teaching experiences (Gnawali, 2008). Based on numerous studies and theories of reflection, and to simplify the topic for this study (Finlay, 2008) defined this process as "learning through and from experience towards gaining new insights of self and practice" (p. 1). Within this reflective space and the inherent converging theories of its importance, Schön (1983) was instrumental in forging the reflective path for professional development and recognized a distinct difference between "reflection-in-action" and "reflection-on-action," underscoring the importance of this process of introspection in employing and adapting teaching methodologies. Effective teaching hinges on the quality of teachers, and research regularly demonstrates that classroom teachers have the biggest influence on students' educational outcomes in both the short and long term (Hanushek & Rivken, 2004; Chetty, Freidman, & Rockoff, 2014), while John Hattie, visionary of Visible Learning, acknowledged an effective teacher as being the prime determinant and driver of student success and learning (Hattie, 2003) furthermore underscoring the importance of active professional development.

Maintaining the conceptual root of reflection, from its early philosophical adoption to being still relevant in contemporary educational settings, the longevity of the 'reflection bandwagon' is a testament to the fact that it 'rings true' (Loughran, 2000). Reflective practice has been continually updated and reformulated, allowing educational practitioners to critically evaluate their experiences as a means for improvement. The aforementioned Schön (1983) described such modes of reflection, while Mezirow (1990) explored this concept of reflection as being not sufficiently transformative, and merely serves to mirror confirmations or underlying beliefs without leading to new schemes or perspectives. In the field of education, Grushka, Hinde-McLeod, and Reynolds (2005) distinguish between 'reflection for action', 'reflection in action', and 'reflection on action' and refer to combinations of technical, practical, and critical questions for teachers to grapple with. In general, despite mass adoption of Schön's work in education, there is also criticism for a lack of overall clarity and precision (Eraut, 2004)) and the omission of reflection context (Boud and Walker, 1998), while Usher et al (1997) claim Schön's theory to be unreflexively structured. In other views on effective reflection, Pollard, et al describe the practice as requiring "flexibility,

rigorous analysis, and social awareness" (2008, p. 14), and thereby as a means of viewing complex actions and situations through different perspectives and ways of seeing (Shulman, 1988 in Loughran, 1996). The idea of awareness is also promoted by (Tomlinson, 2014), on the educational realities teachers may find themselves in, being knowledgeable about all students in the class and their specific interests and learning needs. Building on this, the benefits of self-reflective practice are numerous and well documented throughout educational literature, and the AI chatbot model of reflective practice evaluated in this study is based on the idea that self-reflective individuals will be individuals who think about their thinking, developing metacognitive awareness and crucial "critical thinking" skills (Costa, 2001; Costa & Kallick, 2008).

In terms of teacher education, Larrivee states that unless educators reflect critically, they may "stay trapped in unexamined judgments, interpretations, assumptions, and expectations" (Larrivee, 2000, p.293), and emphasizing this even further, Mckay states that reflective practice is such a fulcrum of professional identity and development that such examination is nothing less than "a professional imperative." (Mckay, 2008). The underlying idea is that if a teacher reflects on a teaching experience, their awareness increases, which enables them to unlearn ineffective habits or teaching methods that may become negative or destructive influences on students' learning experience (Ciampa & Gallagher, 2015). As discussed previously stated on the issues and state of health of reflective practice, evidence shows that many pre-service teachers come to experience reflection as forced or artificial, meaning reflective activities become ineffective and are rigidly bound to categories specified beforehand, which is not conducive towards professional self-exploration, real improvement, and professional development, or ''professional subjectification'' on becoming a fully qualified teacher (Biesta, 2010).

2.3 Transformative Paradigms: Mezirow, Proflection, and AI Integration

This study is focussed on the transformative use of AI in education, which has been approached using different angles of investigation. Indeed firstly, the transformative nature of an AI-based reflective tool directly demonstrates and makes tangible the process of a growth mindset (Dweck, 2006), and students who practice regular reflection in general will be more analytical and insightful about their teaching practice (Danielson, 2007), and thus more pliable to undergo perspective transformation. Moreover, regular practitioners of self-

reflection will be more aware of their unique strengths, weaknesses, tendencies, and habits, and as a result, become more effective and engaging educators (Kolb, 1984).

Ever since Knowles (1970) introduced principles of adult learning, one of the most important theories to emerge in adult education has been transformative learning, as proposed by Mezirow (1990, 1991, 2000). This theory involves fundamental shifts of thinking that occurs through the critical thinking of unexamined assumptions, and examining one's own beliefs and values, which leads to what Mezirow entitles "perspective transformation'' (Mezirow, 1990). This transformative learning process, also known as 'Reflectivity', requires the learner to question and examine unfamiliar views, critically reflect and evaluate, potentially revise their existing frameworks of understanding and belief systems, and ultimately become more autonomous learners and make more informed choices. From the new vantage point, these informed choices will perhaps be reintegrated as new perspectives (King, 2005).

Mezirow emphasized transformation being achieved through "discourse'', whereby learners are encouraged to validate, test, or expand their meaning through these interactive practices. A major component of Mezirow's theory is the concept of "critical reflection," which he differentiates from "reflective action." Critical reflection involves questioning the validity of one's beliefs, assumptions, and expectations in response to an experience and considering alternative perspectives. It's this level of deep, critical reflection that Mezirow identifies as crucial to transformative learning, as it enables learners to make more autonomous and thoughtful choices about how they act. Mezirow's theory of transformative learning is heavily based on the critical theory ideas that were introduced by Freire, Kuhn, and Habermas, and these thinkers were highly influential on the grounding of the theory (Kitchenham, 2008), which Mezirow (2006) formulated as a thinking model of perspective step transformation in a ten-phase process: 1. A disorienting dilemma 2. A self-examination with feelings of guilt or shame 3. A critical assessment of epistemic, sociocultural, or psychic assumptions 4. Recognition that one's discontent and the process of transformation are shared 5. Exploration of options for new roles, relationships, and actions 6. Planning a course of action 7. Acquisition of knowledge and skills for implementing one's plan 8. Provision trying of new roles 9. Building of competence and self-confidence in new roles and relationships 10. A reintegration into one's life on the basis of conditions dictated by one's perspective.

Unlike the other theories mentioned thus far, Mezirow's Transformative Learning Theory provides extra scope for transformation, due to the influential process of critical reflection that adult learners must pass. Less well known, but equally important in the context of transformation, is the concept of 'Proflection' (Moran, 2014). The main assertion of

"Proflection" is rather than focussing on the past, or "the rear-view mirror" (Moran, 2016a), the focus is more future-orientated, and formulated to "encourage participants to proflect, bending forward into tomorrow" (Moran, 2018). In traditional models, such as those previously discussed by Schön and Mezirow, the focus was primarily to analyze past experiences to gain insights into future practices. In contrast, Proflection actively engages participants in a reflection that thinks forward, imagines potential scenarios or situations, and calls for strategies to address these challenges adequately. (Moran, 2018).

The idea of the transformative potential of AI as a whole has been explored by (Gruetzemacher and Whittlestone, 2022) in which the emergence of Transformative Artificial Intelligence (TAI) is a highly relevant topic, with the capacity to significantly alter long-standing societal structures and fundamental human experiences. Already, several indicators are showing the potential for AI to invoke "irreversible societal and economic change across all of society" (p. 9, 2022) akin to the changes brought by the agricultural or industrial revolution, but mainstream media tends to only focus either on immediate impacts of AI or the extreme and remote possibility of human-level or superintelligent AI (Prunkl & Whittlestone, 2020). Unlike the specific tasks that can be performed by narrow AI, or general AI, which replicates human behaviours or cognitive abilities, TAI refers to an AI-driven world that causes profound changes across all domains and shifts in its inherent functionality. This understanding of TAI overlaps with the term "emerging technologies" as defined by Veletsianos (2010), where the concept of emerging technologies was articulated as being those tools, concepts, and innovations that are evolving, yet experiencing hype cycles and are potentially disruptive but still not fully understood or researched maturely. It is beyond this study to elucidate further on whether AI will bring about technological inflection points and massive productivity growth, but the prospect of wholesale transformative change is striking.

2.4 Artificial Intelligence and Technology Acceptance

This paper upholds the many benefits of reflection, such as keeping teaching journals (Suphasri & Chinokul, 2021), self-questionnaires, and the numerous models available, with sharing experiences alongside peers being one of the most effective (Maksimovic and Osmanovic, 2018), but it also investigates the incorporation of AI into this reflection process. Despite the excitement and promise of superintelligence (SAI) and transformative tools, the integration of AI into reflective practices among trainee teachers is an area bereft of exploration. Some myths and stories have included various versions of AI through

mythology, such as Take Talos, a robot created by the great inventor Daedalus to safeguard the island of Crete (Sheikh et al, 2021), yet, our current recognition of the term AI comes from John McCarthy's while working as a computer scientist at Dartmouth College in 1956 (Council of Europe, 2024). For this study, AI will be the term used to refer to all computational techniques that are broadly understood to be AI (Stone et al, 2016) and that are intentionally designed to mimic human behaviour and intelligence (Russell and Norvig, 2010), with AI chatbots part of the class of AI known as generative AI that is based off natural language processing (NLP). These chatbots continuously evolve and learn over time, provide an easy and intuitive language interface, and include certain anthropomorphic features that could activate a feeling of connection with the user and a series of emotions and thoughts that may be beyond what users typically experience while interacting with technology. (Gkinko & Elbanna, 2022).

Given the hype and rapid advancement of AI coupled with geopolitical tensions and overall concern regarding application, privacy, and data protection, the adoption of AI technology is not a foregone conclusion within formal structures. A crucial model about this study is the Technology Acceptance Model (TAM), first proposed by Davis (1989), which provides a framework to identify and understand how technology users come to accept and use a technology. TAM proposes that two main criteria ultimately determine technology use acceptance, perceived usefulness (PU) and perceived ease of use (PEOU). Pedagogical development of teachers using this AI technology would refer to the degree to which a teacher believes that using a certain tool will amplify their teaching practice or professional development, while PEOU relates to the ease at which the technological tool can be utilized. TAM model, which has long been verified as a reliable model (Alkhwaldi & Kamala, 2017), has since been updated to consider the significant cultural, social, and political factors in a context to demonstrate disparities between not just individual choices, but also social and cultural factors. (Chukwuere et al., 2021). TAM has been extensively researched and implemented across several educational settings, examining the relationship between teachers' and students' acceptance of new technological developments, such as in the Malaysian context of student teachers integrating technologies (Wong et al., 2013), though several studies have "have expressed inadequacies of TAM to address the nexus between technology and the actual adoption and use of technology" (Ajibade, 2018), in particular relating to human behaviour. Other notable theories considered include the Technology Readiness Index, with a distinct focus on an individual's mindset when approaching new technologies (Parasuraman, 2000) and the Unified Theory of Acceptance and Use of

Technology (UTAUT), by Venkatesh et al., which amalgamates multiple theories from technology adoption, such as the Motivational Model and the Theory of Reasoned Action. For this study, TAM has primarily been used to explore the students' experiences using the AI chatbots, to best understand their views and interactions with LLM chatbots, and as a vital lens to explore the value of adoption of AI-based tools in reflective pedagogical practice.

2.5 Theoretical Review Conclusion

While the technology may be relatively new, this paper aims to connect the aforementioned educational theories of reflection, such as those of Schön, Gibbs, et al, to the emerging AI technologies at our doorstep, and explore the practical impact of such adoption in terms of how it is experienced by trainee teachers, their level of perspective transformation and the possibility of new reflective paradigms towards an uncertain future.

2.6 Research Gap and Study Contribution

This study aims to address this gap by examining trainee teachers' experiences and perspectives towards using AI chatbots for reflection, and exploring how the use of such tools may impact future professional development through AI-enhanced reflection.

2.7 Research Objectives: Purpose, Significance, and Key Question

There is a clear basis for undertaking this research, mainly stemming from this author's own experiences as a teacher, and subsequently, as a teacher trainer, where reflective practice is a key component of professional development and assessment for all new teachers. It is one of the areas that students can struggle with the most, often resulting in quite superficial reflective submissions and mild neglect or disparagement by students, due to a lack of time, application, or adequate knowledge. At present powerful AI technologies threaten to dominate the learning and development of students, with many already highly familiar with AI technology and its usefulness in planning, resource building, and creating learning activities. Nonetheless, ensuring that teachers are prepared to make the pedagogical decisions and approaches for students is of paramount importance, and therefore, this research seeks to identify how effective AI chatbots can act as a reflective aid during teaching practice.

The research question was defined as the following: *What are the experiences and perspectives of trainee teachers regarding the transformative use of Artificial Intelligence as a reflection tool?*

To answer this research question, trainee teachers of the ITESS study program for international secondary school teachers were chosen to explore and discuss their experiences.

Chapter 3 – Methodology

3.1 Research Design

This study uses qualitative design and adopts a post-phenomenology approach to research and explore the role of AI tools in the reflective practices of trainee teachers. Qualitative research employs interpretive or theoretical frameworks to uncover human issues from the perspectives of individuals or groups (Cresswell, 2016), and this study is set up to understand student teacher's perspectives on using generative AI tools, specifically ChatGPT, Gemini, and Riff, while engaged in and conducting reflective practice during their teaching placement of 8 weeks. This exploratory study is designed to include teachers as participants of the study, not only as objects of this research (Matthews & Ross, 2010), and given the new relatively recent breakthroughs of AI within education and the somewhat speculative use of such tools towards reflective practice, a qualitative approach was deemed the most suitable methodology to understand these experiences and outcomes.

All three AI tools are natural language processing chatbots based on large language models, with Riff being specifically designed to "augment individual reflection with questions that invite the learner to go deeper in the initial exploration of their experience" (Cavagnaro, 2023). The students interacted with a Chatgpt reflection tool that was contextualized with background information relating to the learning outcomes of the teaching program, as well as several pre-defined prompts that the students had the option of using to start conversations. Google Gemini wasn't tailored to the student's specific context, though the students were also recommended to complete their twice-weekly interactions using a specific professional dilemma or individual smart goal, to stimulate an effective reflection process.

All students were requested to interact at least two times every week, preferably shortly after their completed lessons for that day. Qualitative methodology was chosen for this study due to the focus on exploring the depth of human experiences and perceptions, and the diverse meanings that subjects draw from particular interactions with AI technological tools. By

employing this focus on qualitative data, it is expected that deep insights will become apparent regarding the impact and potential of AI tools as a tool for reflective practice within education.

3.2 Sample Selection

For this study, the chosen sampling technique was purposive sampling, also called judgement sampling, whereby the choice of a participant is made from to the specific qualities that the participant possesses. It is a nonrandom technique not bounded by theories or a fixed number of participants, whereby the researcher decides what needs to be known and locates people who are willing and able to provide this data as a result of their knowledge or experience' (Etikan et al., 2016, p.2). In this case, the research was focused on understanding how trainee teachers would experience AI tools during their teaching placement in an international teaching training programme. Based on this, the criteria of the sample were chosen as the following:

- The participants were in at least the second year of their trainee teacher programme
- Teachers had prior experience using reflection techniques

The adequate number of participants was also an important aspect of the sampling method, with a sample size of 12 respondents being deemed sufficient and suitable for this study. In terms of accessibility and this author's current role as a lecturer and teacher trainer in the ITESS academy, this sampling approach gave access to the participants of this study without much difficulty. Of the 12 students who had agreed to use the tools, only 9 of the students engaged in the tools due to personal issues unconnected with their teaching placement, which reduced the number of respondents for the qualitative interviews. The students who took part in this study are from a diverse group of nationalities and cultural backgrounds, which ensures a collection of perspectives and experiences that is wide and authentic to an international audience.

3.3 Data Collection Methods

The strategy for collecting data in qualitative research is often based on conducting in-depth interviews and focus groups, using a small sample size to gather large and meaningful amounts of data (Hox & Boeije, 2005). Considering the focus of this study on understanding the perspectives, thoughts, and experiences of trainee teachers while on work placement, in-

depth interviews were decided upon as the main data collection point of this research, as these types of interviews can offer a quality and understanding of a research question based on a smaller group of participants and allow issues to be explored in depth (Boyce & Neale, 2006). It is thought that a sample size is sufficient when similar topics and themes are visible from the interviewees (Boyce & Neale, 2006), and for this research, four interviews of paired participants were conducted, with one student preferring to do this research on an individual basis for personal reasons. The primary data collected was used to address the RQ, and all interviews were completed online to minimize disruption for participants or necessitate extra travel time to campus. The consent of all participants was received (Appendix 1), and audio transcripts using Zoom were used to ensure accurate and efficient data collection, which was checked for accuracy subsequently. The interviews were guided by a pre-written collection of ten questions that were specific but also open-ended, and which provided scope for an exploration of emerging themes and probing of thoughts, insights, and experiences.

In addition to the main data collection of qualitative interviews, selected sections of the interaction logs conducted by the students are used to explore or elaborate on certain themes with more precision. These are the logs that are available on the three AI chatbots, and also on the Microsoft Teams page that was created so the students could share their weekly reflections. It was agreed that students would interact twice per week during the full period of their teaching placement, approximately 8 weeks, and post these reflections to their individual teams channels. This data is used for selective purposes only, as the main focus of this study is to explore how the students perceive the interactions with these AI tools, but it also serves as robust evidence of the nature of the interactions and offers valuable insights in its own right. For this study, the extracts used were mainly to illustrate the professional development potential and shifts of perspective of the students, rather than their own subjective experience or recollections.

3.4 Data Analysis Methods

Analysis of all data collected was conducted through a thorough thematic analysis, based on Braun and Clarke's six-phase framework, which allowed the freedom and flexibility to provide a rich and detailed account of data (Braun & Clarke, 2006). The six steps involved getting to know the data and transcribing it ensuring accuracy, creating a set of systematic codes for the whole data set, identifying potential themes and gathering all data relevant to

each theme, assessing whether the themes would work based on all the codes extracted from the data set and thus creating a thematic map of the analysis, before eventually defining and naming the themes and checking for overall cohesiveness. Once the analysis was conducted correctly and diligently, rich themes began to emerge from the derived data (Rubin & Rubin (1995). It should be noted that this was not done on the interactive logs in the same way, but a thorough reading was completed on each log and some extracts that supplemented the main ideas for discussion were added as an extra layer of depth to the exploratory study. Once this was done, a report was written on the data and the most compelling and relevant extracts from the data were used to illustrate themes that emerged, and the results and discussion revolved around the data collected and how it connected to existing literature on the topic. This also allowed reflection on the study as a whole and the opportunity to offer suggestions on the future development or deployment of AI tools in the field of education from a scholarly standpoint.

Chapter 4 – Results

4.1 Background information

This study was undertaken in the academic year of 2023/2024, during the teaching placement period for trainee secondary school teachers in the international teaching program of NHL Stenden (ITESS), in the Netherlands. The placement period for the trainee teachers takes place once a year in the authentic context of international or bilingual education, and under supervision, for a period of between 8 and 11 weeks, where students are expected to show that their pedagogical content and knowledge are sufficient to facilitate student's learning and development, with specific criteria related to their year of study in the 4-year program. In this study, 8 students were in their second year of study, with one student in their final year. The teaching placements were based across schools in Europe, in Belgium, Ireland, Switzerland, Spain, and Portugal, with the purpose of the teaching placement being to merge theory and practice. At the end of the teaching placement, students are expected to meet a range of teaching competencies which is demonstrated through submission of a teaching portfolio. This portfolio includes a prepared lesson plan, student and mentor feedback forms, and a large emphasis placed on the reflection component, where students analyse and discuss their personal development according to pre-defined smart goals and their progress toward meeting the respective teaching competencies of the teaching program, such as interculturally

sensitivity, communication, and pedagogical skills. Reflection itself is also a key teaching competency for trainee teachers, and the students have been exposed to various models of reflection during their studies up until this point, such as the Korthagen model, STARR reflection, and learning journals.

4.2 AI's Impact on the Depth and Quality of Reflective Practice

The first theme that emerged from the data was related to how AI tools influence the depth and quality of reflective practices among trainee teachers, in addition to how the tools facilitate the process of reflection. This was demonstrated through statements such as *"it allowed me to go deeper into more details into…what I wanted to talk about"*, with another student declaring "*I think now my reflections are getting better and more focused*". Each participant interviewed at various points made several references to either an increased perception of reflective depth in their thought process, or a perception of having undergone a better-quality reflection, with one student noting that '*it makes your reflection more natural".* While using the reflective chatbot Riff, one student explained how Riff helped her structure her thoughts and dig deeper into reflection, stating "*Riff was a way of supporting and structuring my reflections... making me think even more in a deeper way*,". The same student believed that using Riff allowed her to conduct more focused reflections and less diary-style responses over time. Riff was also noted to allow some students to reflect on their teaching in different ways, with more detailed reflection possible during some challenging and significant moments, with one student commenting that "*This tool helped me... look at it in different ways,"* before adding that it also prompted her to explore Riff's different scenarios and solutions. One student positively described this process as being beneficial as *"it's not just like your own head directing it".*

Specifically while using Chatgpt, one student reflected on a teaching dilemma he was facing where he was acting too strict, he was then able to alleviate the tension by making the conversation more personal, after receiving feedback from Chatgpt to balance firmness with approachability, thus reinforcing his teaching style "*Chatgpt was the tool that provided me with the insight: I am building a style that I'm not fully strict but also not fully friendly*" the student explains. Another student, who also reflected on using Chatgpt, revealed how using the tool allowed him to delve deeper into his reflection, and over time, led to more focussed and deliberate reflections "*I kind of learn more about how to develop myself as a teacher because of the questions that were being asked*," he said, mentioning how the interactions

with the chatbot led him to think about aspects and perspectives he might not have considered otherwise concerning meeting teaching competencies such as classroom management and didactics, as required for his placement. In terms of structure, another student was very appreciative and aware of this dynamic and the *"several perspectives*" that she could look into," stating how the tool facilitated a more thorough reflection on her meeting the teaching competencies of her placement. The same student discussed the different layers of reflection being made possible while using Chatgpt, which allowed her to see "*what went good and what went wrong*" and how to connect them to her professional development.

For students using Google Gemini, similar sentiments were expressed, with one participant detailing how using Google Gemini allowed her to reflect more thoroughly "*It asks questions to help me think about what I've done,*" she noted, before then explaining how use of the AI tool led her towards considering diverse aspects of her teaching and development, which otherwise might not have occurred. The only other student using Google Gemini in this study also noted how using the chatbot, "*brings on another question that you might not always think about,"* which acted as a catalyst for deeper self-reflection. The same student also discussed how using the tool facilitated a more effective reflection process, highlighting the tools' ability to provide structure with feedback, and guiding reflections on some important aspects of teaching, "*it makes me think of ways to improve for the next time",* he said, stressing how the AI tool had helped him to refine and improve his teaching strategies. He spoke openly about the probing questions and deepening insights gained from the interaction "to ask questions that maybe I would not have thought otherwise…because it's not just you".

4.3 Influence on Critical Reflection and Shifts in Perception

This theme explores how AI tools promote critical reflection and perspective shifts in teaching practices, with specific examples also taken from the interaction logs provided by the students, to identify specific moments of perception changes and critical thinking. Many students explained and elaborated on various moments when using all three AI chatbots for reflection prompted greater critical awareness of their teaching methods, and changes in their perspective or viewpoint, viewing them as helpful opinions from a "*completely neutral device"* that can be a catalyst for introspection *"I can look at it and think to myself, do I agree with this? Do I not agree with this?".*

One participant described how using Riff led her to re-evaluate her approach to dealing with an incident involving bullying and to consider different strategies. *"Riff showed me... different*

approaches I could use," she explains. While using Chatgpt, one student described how using Chatgpt led him to analyse and reflect upon the challenges and opportunities for improvement in his teaching practice. "*I had a situation with a mentor teacher, and my approach... is to disappear and let them be on their own. Chatgpt led me to consider alternative strategies*" he states. Indeed, the same student acknowledges that using the tool caused him to re-evaluate his whole approach to dealing with professional relationships and management of the classroom "It's clear that these situations have been difficult and have influenced my approach," he reflects, before emphasizing the need for long-term strategies and adaptation.

One student using Google Gemini spoke about how it prompted her to evaluate different teaching strategies, particularly for improving classroom management. *"It challenges your own thoughts and gives you extra input"* she states. In the same interview, another participant reflects on how Google Gemini also acted as a guide for him to consider alternative strategies for managing the process of feedback, stating, "*It brings up different angles I might not have considered.*" This opinion was prefaced by the same student revealing the contrast between reflecting through other methods "*before I would just do it on paper…(but) when you use AI it kind of brings on another question that you might not always think about*". Changes in perspectives were also acknowledged by the students, as one particular student started to view reflection as a more structured and insightful activity, which allowed her to focus more clearly on her actual teaching goals. "*It makes me more aware of this"* she explains.

In terms of envisioning future classroom management and proactive planning, one student stated, "*For me it was those instances... if I would be reflecting on classroom management it would make me think about ok what strategies can you use next time or how can I do this better next time".* Another student, when discussing the "multiple perspectives" that Chatgpt created for her through questioning, felt that it was much better than the star method she was accustomed to, "*when I use Chatgpt it became like more deeper*" and became very future focussed from the interaction. The same student also said after this teaching placement "*I would still love to use Chatgpt to help me reflect my teaching situation*". While interacting with Google Gemini, one participant noted how her planning for the future was improved "*now I can focus on this specific goal to make my students listen better. So, in that way I think it has kind of helped".*

4.4 – Challenges, Concerns, and Barriers to Implementation

This theme explores the challenges and barriers in using AI for reflective practice, in terms of technical and navigational challenges, as well as barriers to adoption. For the students using Riff, several students reported difficulties receiving summaries from their interactions, including delays and key information missing. One student said, "*Sometimes it sent me just half of the chat"*. More students discussed other technical difficulties, including missing feedback. "*I didn't receive the feedback,"* one student complained, before adding that the new link provided eventually helped to resolve this issue. Another student explained that while using Chatgpt, he was sometimes provided with contradictory responses, which required some manual filtering or editing on this part. "*It can contradict itself a little bit sometimes because it's a machine"* he explains "*it cannot think like we humans do*". While using Google Gemini, both students indicated that sometimes it gave suggestions or ideas that didn't apply to their teaching contexts. *"It's suggesting things that don't really apply to the situation*" one student stated. In addition to this, one student described how the suggestions may not be entirely relevant "*It doesn't know the whole backstory*" he stated.

These challenges were also brought up alongside other issues that could block adoption, such as the need for adjusting Riff's reflection prompts, and the difficulty of connecting reflections with individual smart goals. Some students reported initial worries about the privacy aspects of using chatbots, while others expressed concern about the level of responsibility afforded to the chatbots. "*There needs to be clear criteria... to what constitutes responsible AI use from irresponsible AI use*" he urged.

Other barriers to adoption detailed by the students include the time needed to get more prompts to guide reflection. "*It took time to get more concrete answers"* he explained. In general, despite some issues and complaints, all students were able to find ways to navigate the challenges that were part of using the three AI chatbots.

4.5 AI in Future Professional Development and Transformative Potential

This theme consolidates study participants' perspectives on how AI tools might integrate into reflective practices in the future, based on their experiences of using AI chatbots during their teaching placement. Students using the chatbots agreed that AI tools in general can play a significant role in reflection, which is evident from their previous comments on the use of AI, but also their enthusiasm for offering many suggestions on future enhancements. When using

Riff, one student mentioned the potentially valuable future role of Riff, as "*it can give you questions that lead to... more structured lessons"* she noted, emphasizing its suitability for international settings. Riff also revealed interesting responses from the students as not only being useful for reflections. but also, to structure thoughts. "*I had all this bunch of information in my head, and I never know how to structure it…but with Riff, it makes me like put my thoughts into an order so, it's like my template...it helped me to structure my brain and my thoughts*". Another emphasized a similar phenomenon whereby before her reflections were "*more like a summary that wasn't really reflective…or didn't go into details*" but now her reflections were more purposeful due to the "*fixed structure*" of the chatbot.

While using Chatgpt, it was noted by one participant that he viewed AI tools playing a significant role in future teaching practices. *"I think using Chatgpt as a reflection tool... is going to stay with me for quite some time"* he stated, while another student wished to use Chatgpt to "*grow more as a teacher".* Students also noted the guidance and friendship aspect of using the chatbots, in particular when assigned mentors are busy and unavailable, *"it can be your friend as well during teaching practice".*

Other proposals by the students "*creating a folder with all my reflections... for future comparison,"* or methods to scan previous conversations and "*make it more personal"*, were suggestions encouraging future integration, and practical recommendations for the chatbot to save conversation history for the user and offer summaries "*storing conversation history... helps track progress"* one participant advises. Another student also recommended integrating features such as audio interaction, "*it might feel more real*" she said.

Students outlined its scope for triggering changes in their thinking and behaviour, which can directly improve the learning experience for current and potentially future students. After using Riff one student shared how it led her to consider strategies for improving classroom management, "i*t made me think... and support my initial approach more"* she explains, while another student acknowledges how Riff's structure helped to guide her towards new teaching strategies. "*it's a checklist... taking into account everything to reflect on*" she explained. One student shared that she was struggling with her classroom management in terms of how best to differentiate and achieve her lesson objectives, "*but after reflecting with Gemini, I actually realized I could add more differentiation to help my students write their texts better*".

In addition to the results of the qualitative interviews, which offer many insights and examples of deeper reflection, reviews of interaction logs of the students also show some significant findings, with several examples from the Chatgpt log displaying elements identifiable using Mezirow's theory of transformative learning, such as disorienting dilemma,

self-examination, and critical reflection, before eventual acquisition of new knowledge and skills and the incorporation of these new skills into one's worldview. In one example, a student starts with "*today I had an argument with one of my mentor teachers"* (disorienting dilemma) and through a dialogue with the chatbot, a thorough analysis of the situation ensues with the student soon declaring "*everything that I think I mind about her is something that I would most likely do if I were in her position."* The student is planning to build his competence in navigating professional relationships by seeking support from his internship supervisor "*I will discuss this with my internship supervisor and see what kind of feedback I can get from him to move forward"* before eventually reintegrating the new perspectives into his final reflection, and stating "*the truth is, I think she's a very good teacher and I wouldn't do things too differently."*

There is another similar example in the Chatgpt interaction log indicative of the transformation learning that is proposed by Mezirow, in which the same student appears to experience transformative change after finding himself present in another disorienting dilemma that was a clear challenge to his pre-existing beliefs about classroom management. After going through the discourse with Chatgpt and by critically reflecting on his behavior and assumptions through the AI probing and questioning, he eventually takes on new insights into how to create and maintain a safe learning environment, which leads to what appears to be a substantial change in his professional teaching practice and outlook. In this example, the dilemma in question leads to the self-revelation of having "*failed to foster a safe learning environment for my students, which should always be the priority"* and eventually drives him to strive to collaborate with his supervisor "to develop a plan for restoring trust'' which is integrated into the students' new professional mindset.

These results are "hand-picked" from the data, and speculative, but in the context of this study, are relevant and align with the general trend of data from the qualitative interviews. It should also be noted that there were muted responses from students when asked whether their opinions of interactions with the chatbots brought a truly transformational change in their professional outlook and teaching. For example, one student said that it changed this perspective of teaching "*a little bit, but not in a really massive way",* while another student agreed that it wouldn't be in a major way, but "*it does have an impact about what you think because it makes you have a different perspective".*

Chapter 5 – Discussion

The many insights garnered in this study, in the evolving landscape of educational technology, highlight important areas that have emerged, such as AI not only enhancing the perceived depth and quality of reflection amongst educators but also exposing some of the challenges and complexities that exist in its adoption. Schön's theory of reflection-on-action postulates that professionals develop and grow best through the engagement of a reflective process on their past experiences, which in turn influences future actions and decisions. The study has been designed in such a way that the AI chatbots in question, Chatgpt, Google Gemini, and Riff, have acted as catalysts to spur on the reflective experiences of participants, who have reported significantly deeper reflections in their interviews and channeled new perspectives. The chatbots, in addition to identifying underlying beliefs and assumptions and creating a mirror, also appear to serve a diffractive purpose, breaking ideas and beliefs into different directions, such as when a light or a "wave alters, bends or passes through an opening" (Lafton, 2016, p.36, as cited in Moxnes and Osgood). Indeed, should diffraction occur, it may allow trainee teachers to view their own pedagogical and didactical approaches in a different light, and the results of this study allude to this effect.

In addition to this extra depth and range of perspective, participants consistently reported greater levels of structured thinking, due to the mechanical and "fixed" nature of the chatbots, which allowed them to structure their thoughts more concisely and thus critique their teaching practice with greater precision and clarity. This aspect of the interaction points to an intriguing post-phenomenological effect, whereby the structured and repetitive approach of a chatbot appears to positively aid some students in analysing and articulating their thoughts and ideas more succinctly, which in turn may also lead to a follow-up question on whether this phenomenon is something to be truly desired for in a profession that is primarily rooted in empathy, sensitivity, and awareness. It draws parallels to transhumanism, whereby technological innovation aids to make our senses, intellect, emotions, and rationality more enhanced (Doede, 2014), to improve performance and function. Additionally, there are also substantial examples in psychology that reveal the bias, poor decision-making, and lack of rationality that can be present in humans, (Tversky & Kahneman, 1974), perhaps strengthening the case for chatbots to correct these blind spots.

In terms of core reflective practice, the data collected suggests that AI-enhanced reflection can indeed model an effective reflection process that is loosely based on reflection-on-action theory and thus potentially leads to superior professional growth and teaching practices. Reflection by Schön is primarily based on looking back over experiences and past actions, but there were also occasions where participants demonstrated a much more forward-thinking approach to reflection in this research, which aligns with the concept of "Proflection" by Moran, which is not limited to reviewing and analysing past experiences but also seeks to use learning experiences and insights to guide and innovate. Participants regularly shared moments of critical reflection and insights gained from the chatbot interactions that caused them to think and react beyond the usual confines of their own immediate and limited cognitive capacity and thus benefitted from the diffractive effect created by the specific chatbot interactions. The dual approach of using AI-supported forward-thinking Proflection may bring about enhanced professional development for educators, as it ensures that they are not only enlightening their practice but also becoming well-drilled in navigating daily and weekly challenges in and beyond the classroom, which ultimately enhances the overall teaching and learning in schools.

In terms of the discussion based on AI being truly transformative in nature, and in recognition of the need for innovation, development, and critical thinking from educators across the world, it certainly appears that AI-based reflection tools can impact education in a profound manner. The dynamic of reflection that was utilised by the students of this research was both introspective and prospective and encouraged a deeper reflective practice than had previously experienced using alternative methods. The extent to which this type of digital interaction is suited to a young and tech-savvy population in a rapidly changing and complex global landscape is debateable, particularly when the soft skills of collaboration and empathy are touted as the 'skills of tomorrow'. This may be a further step towards post-humanity, or a path that is destinated for Augmented Intelligence where both machines and humans can complement each other's strengths (Zohuri and Mossavar-Rahmani, 2024), or indeed the ecology of technology, which James Bridle argues for in his book ways of being, where an intelligence in which humans coexist and interact with technologies is eminently possible.

Overall, this study explores the experiences of a small group of trainee teachers using AI-assisted reflective practice during a teaching internship and the findings suggest that AI chatbots can facilitate deep critical analysis, leading to fresh perspectives and professional

growth. There is sufficient qualitative data from this study to suggest that if AI is designed and utilized thoughtfully and with clear goals in mind, it could serve as a driver for real transformation in society through improved educational practices in a myriad of ways. The ability of AI to surprise and inform the user of different perspectives based on vast banks of knowledge and content and to conjure questions that cause educators to critically examine their teaching strategies and assumptions could be the starting point of true change in society on a fundamental level, for better or for worse. As one student stated about his change in adaptation and diplomatic thinking as a teacher while reflecting with Chatgpt, "*it is something that's on my mind and it started with the AI tool*".

This impact of AI in education may become visible through improved learning experiences for students across the world, superior teaching methods being implemented, more effective differentiation, greater inclusivity, and perhaps most importantly, teachers who enjoy and succeed in their jobs. Each year the attrition and retention rates for teachers are deteriorating across the world (Borman & Maritza Dowling, 2008) yet, despite the inherent risks of greater AI implementation, there is a clear opportunity for increased morale, motivation, and execution among teachers from greater adoption.

The application of LLMs undoubtedly has potential for use in reflective practice, despite some concerns and frustrations using the chatbots, such as the sporadic technical difficulties and contradictions. This ties in with the Technology Acceptance Model which measures the perceived ease of use and usefulness that is crucial towards real integration and implementation of new technologies. Generally, the participants' overall positive responses to using AI-based reflective practice indicate that these AI tools do meet these criteria, however, as the students pointed out, they don't see technology as a complete substitute for a real mentor for human-generated understanding, experience, and expertise.

The integration of AI into reflective practice offers a notable opportunity to improve the demanding yet imperative process of reflection, foster critical thinking, and innovation, and enhance teaching practices among educators. Beyond the advances of intelligence or 'Transhumanism,' deeper reflective experiences will enable teachers to adopt diverse perspectives and teaching methods, potentially transforming their pedagogical expertise. AI can play a crucial role in addressing the increasingly complex challenges of the 21st century and beyond, but its implementation should be approached with caution. Despite the aforementioned uses of AI, there is the danger of a 'race to the bottom mentality'

characterized by rapid advancement in AI. Drawing from the mythological Hebrew landscape of Moloch, the evil child sacrificing God (Donaldson, 2017), current exponential growth in the AI industry is comparable to a 'Moloch Trap' situation that is characterized by destructive and harmful power dynamics between rivals, eventually resulting in generally negative effects on a wider scale or even outright calamity. It appears AI companies are currently in a race, as is typical of emerging technologies during the hype stage, whereby if companies halt or restrain development while others are accelerating, the risk of falling behind their competitors becomes too great, such as countries and companies exploiting fossil fuel resources for future economic and political gain. Nonetheless, this paper is optimistic about the positive role AI can play in transforming society, through adequate policy and regulation, a clear focus on positively shaping educators' roles and future learning outcomes, and as a tool to aid development and progress, rather than to subjugate.

There are indications of the power of AI reflection chatbots to greatly aid with professional reflection, but also of their capability to influence the thoughts and mental patterns of student teachers, which is an aspect of deployment that is both exciting and concerning, and one that is open to a philosophical and sociological debate on our value and existential purpose as humans. Undeniably we are in the midst of a significant political, technological, and educational transformation in the world today and as AI becomes increasingly prevalent, society must decide how to use it, implement and regulate it responsibly. By doing so, we can best traverse the transition to a more effective, inclusive, and dynamic educational landscape, for students, educators, and the chatbots of tomorrow.

5.2 Implications

AI chatbots can serve well as a mechanical sparring partner of sorts, a technological tool that is highly advanced at tirelessly providing immediate and structured feedback, which can help teachers delve deeper into reflections and see different perspectives. Due to the structured nature of the experience, finding patterns through prediction models may also influence the thoughts and mental patterns of users to become more structured and insightful in their analysis, with subsequent perspective shifts or transformations. Therefore, if AI tools can noticeably contribute to the continued professional growth and development of teachers through more effective reflection and instigating insights that may not otherwise be apparent

through more traditional models, they could have a big part to play in future reflective practice. This comes with the risk of seeing problems in the educational system or the current practice of reflection, as ones that can also be solved with AI, due to its growing prevalence in our lives through the deluge of products, media hype, and industry automation, yet education, at its core, is a human activity. Interactions that are conducted with specific chatbots may be of considerable support and assistance to novice teachers, in particular for helping them reflect deeper through the structured interactive process and endure difficult moments or situations through guidance being always available. Lastly, AI may have the potential to offer a more customized and personalized reflective practice experience that is more difficult to achieve via traditional methods and the inevitable limitations of mentor availability, time, and poor understanding of reflective practice amongst novice teachers.

5.3 Limitations

Despite the positive exploration of these approaches, more adoption of AI into future teacher reflective practice may ultimately lead to technological dependence on the tool for forming ideas, rather than the cultivation of the teacher's independent reflective skills. The incorporation of AI chatbots into reflective practice also runs the risk of informational inaccuracy or falsities that may create suboptimal advice to teachers, or 'hallucinations', which was a concern voiced by several teachers in this study. In terms of reliability and accuracy, AI chatbots may communicate biased responses or false information to users (Kasneci et al., 2023; Sedaghat, 2023). This is notable given that certain students commented on how quickly the interactions began to noticeably "structure" their thoughts and brains. There are valid ethical concerns and data privacy issues about the use of AI tools in personal reflections, and data management needs to be secure and used responsibly. It doesn't take much imagination to see how reflection information could be mishandled, by schools or companies that provide these services. In general, the use of AI chatbots for reflective practice instead of traditional human-centred interaction, is a concern of this paper, as AI tools certainly cannot replicate the human contact, connection, and reciprocity of emotional discourse, nor the insights or personal experiences from a traditional mentor. Finally, the findings that are presented in this research are based on a small sample size of teachers and may not apply to all educational contexts or every trainee schoolteacher.

5.4 Conclusion

The research indicates that AI tools like Chatgpt can significantly enhance reflective practices in teacher education by providing structured, personalized feedback and supporting professional growth. Nevertheless, it is essential to address the limitations related to technological dependence, quality of feedback, ethical concerns, and the human need for connection and purpose. Nothing ever will or should replace the empathetic nature of a truly dedicated teacher, or the nuanced sensitivity of a skilled and experienced educator. Mark Weiser once stated that ‘the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it” (Weiser, 1991). Given the universal vested interest in education, educators, researchers, and leaders must make a concerted effort to explore and determine if and how these technologies should be integrated into teacher education before they seamlessly merge into the new reality.

List of references

Ai, A., Al-Shamrani, S., & Almufti, A. (2017). Secondary school science teachers’ views about their reflective practices. *Journal of Teacher Education for Sustainability*, 19(2), 43–53. https://doi.org/10.1515/jtes-2017-0003

Aliakbari, M., & Adibpour, M. (2018). Reflective EFL education in Iran: Existing situation and teachers’ perceived fundamental challenges. *Eurasian Journal of Educational Research*, 18(77), 1–16. https://doi.org/10.14689/ejer.2018.77.7

Alkhwaldi, A. F. A., & Kamala, M. A. (2017). Why do users accept innovative technologies? A critical review of models and theories of technology acceptance in the information system literature.

Barnett, B. G., O'Mahony, G. R., & Matthews, R. J. (2004). *Reflective practice: The cornerstone for school improvement*. Australia: Hawker Brownlow Education.

Beauchamp, C. (2015). Reflection in teacher education: Issues emerging from a review of current literature. *Reflective Practice*, 16(1), 123–141.

Biesta, G. (2010). What is education for? In *Good education in an age of measurement: Ethics, politics, democracy* (pp. 11–27). Boulder, CO: Paradigm Publishers.

Boud, D. (2010). Relocating reflection in the context of practice. In H. Bradbury, N. Frost, & S. Kilminster (Eds.), *Beyond reflective practice* (pp. 25-36). New York, NY: Routledge.

Boud, D., Keogh, R., & Walker, D. (1985). Promoting reflection in learning: A model. In D. Boud, R. Keogh, & D. Walker (Eds.), *Reflection: Turning experience into learning*. London, UK: Routledge.

Boud, D., & Walker, D. (1998). Promoting reflection in professional courses: The challenge of context. *Studies in Higher Education*, 23(2), 191-206.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.

Bridle, J. (2022). *Ways of being: Animals, plants, machines: The search for a planetary intelligence*. Penguin Books (Allen Lane)

Ciampa, K., & Gallagher, T. (2015). Blogging to enhance in-service teachers' professional learning and development during collaborative inquiry. *Educational Technology Research and Development*, 63(6), 883–913. https://doi.org/10.1007/s11423-015-9404-7

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review*, 104(9), 2633–2679.

Childs, A., & Hillier, J. (2022). Developing the practice of teacher educators: The role of practical theorising. In K. Burn, T. Mutton, & I. Thompson (Eds.), *Practical theorising in teacher education: Holding theory and practice together* (pp. 40-57). London, UK: Taylor & Francis.

Chinokul, S. (2012). Development of EFL teaching skills: Knowledge transfer from methodology course to real classroom practice. Thailand Science Research and Innovation. https://cmudc.library.cmu.ac.th/frontend/Info/item/dc:129775

Chukwuere, J. E., Ntseme, O. J., & Shaikh, A. A. (2021). Toward the development of a revised technology acceptance model. In *Proceedings of the International Conference on Electronic Business*. International Consortium for Electronic Business.

Costa, A. (Ed.). (2001). *Developing minds: A resource book for teaching thinking*. Alexandria, VA: ASCD.

Costa, A., & Kallick, B. (Eds.). (2008). *Learning and leading with habits of mind: 16 essential characteristics for success*. Alexandria, VA: ASCD.

Council of Europe. (2024). *History of artificial intelligence*. Retrieved from https://www.coe.int/en/web/artificial-intelligence/history-of-ai

Danielson, C. (2007). *Enhancing professional practice: A framework for teaching* (2nd ed.). Alexandria, VA: ASCD.

Davies, S. (2012). Embracing reflective practice. *Education for Primary Care*, 23(1), 9–12. https://doi.org/10.1080/14739879.2012.11494064

Dewey, J. (1910). *How we think*. Boston, MA: D.C. Heath & Co.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York, NY: Macmillan.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Boston, MA: D.C. Heath & Co.

Doede, R. (2009). Transhumanism, technology, and the future. *The Appraisal Journal*, 7(3), 39–54.

Donaldson, I. M. (2017). The 'bloody Moloch': Osler and van Helmont on bloodletting. *The Journal of the Royal College of Physicians of Edinburgh*, 47(2), 196-204.

Dweck, C. (2006). *Mindset: The new psychology of success*. New York, NY: Ballantine Books.

Eraut, M. (2004). Editorial: The practice of reflection. *Learning in Health and Social Care*, 3(2), 47-52.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4.

Fendler, L. (2003). Teacher reflection in a hall of mirrors: Historical influences and political reverberations. *Educational Researcher*, 32(3), 16–25.

Finlay, L. (2008). Reflecting on 'reflective practice'. Practice-based professional learning paper 52. The Open University.

Georgii-Hemming, E., Johansson, K., & Moberg, N. (2020). Reflection in higher music education: What, why, wherefore? *Music Education Research*, 22(3), 245–256. https://doi.org/10.1080/14613808.2020.1766006

Gibbs, G. (1988). *Learning by doing: A guide to teaching and learning methods*. Oxford, UK: Oxford Polytechnic, Further Education Unit.

Gnawali, L. (2008). Teacher development through reflective practice. *Journal of Education and Research*, 1(1), 69-71. Retrieved from https://kusoed.edu.np/journal/index.php/je/article/view/77

Grimmett, P. P., & Erickson, G. L. (Eds.). (1988). *Reflection in teacher education*. New York, NY: Teachers College Press.

Grushka, K., Hinde-McLeod, J., & Reynolds, R. (2005). Reflecting upon reflection: Theory and practice in one Australian university teacher education program. *Reflective Practice*, 6(1), 239-246.

Guillaumier, C. (2016). Reflection as creative process: Perspectives, challenges and practice. *Arts and Humanities in Higher Education*, 15(3), 353–363. https://doi.org/10.1177/1474022216647381

Gruetzemacher, R., & Whittlestone, J. (2022). The transformative potential of artificial intelligence. *Futures*, 135, 102884.

Hanushek, E. A., Kain, J., & Rivkin, S. (2004). Why public schools lose teachers. *Journal of Human Resources*, 39(2), 326–354.

Harscher, T., Cocard, Y., & Moser, P. (2004). Forget about theory, practice is all? Student teachers' learning in practicum. *Teachers and Teaching: Theory and Practice*, 10(6), 623–637. https://doi.org/10.1080/1354060042000304800

Hattie, J. (2003). Teachers make a difference, what is the research evidence? *Australian Council for Educational Research*. https://www.research.acer.edu.au/research_conference_2003/4/

Hobbs, V. (2007). Faking it or hating it: Can reflective practice be forced? *Reflective Practice*, 8(3), 405–417. https://doi.org/10.1080/14623940701425063

Hox, J. J., & Boeije, H. R. (2005). Data collection, primary versus secondary. In K. Kempf-Leonard (Ed.), *Encyclopedia of social measurement* (Vol. 1, pp. 593-599). Amsterdam, Netherlands: Elsevier.

Huynh, H. T. (2022). Promoting professional development in language teaching through reflective practice. *Vietnam Journal of Education*, 6, 62–68. https://doi.org/10.52296/vje.2022.126

Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., & Hüllermeier, E. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274.

Khogali, H. O., & Mekid, S. (2023). The blended future of automation and AI: Examining some long-term societal and ethical impact features. *Technology in Society*, 73, 102232. https://doi.org/10.1016/j.techsoc.2023.102232

King, K. P. (2005). *Bringing transformative learning to life*. Malabar, FL: Krieger Publishing Company.

Kitchenham, A. (2008). The evolution of John Mezirow's transformative learning theory. *Journal of Transformative Education*, 6(2), 104-123.

Knowles, M. S. (1970). *The modern practice of adult education: Andragogy versus pedagogy*. New York, NY: Association Press.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

Korthagen, F. A. J. (2004). In search of the essence of a good teacher: Towards a more holistic approach in teacher education. *Teaching and Teacher Education, 20*(1), 77-97.

Knassmüller, M. (2022). The challenges of developing reflective practice in public administration: A teaching perspective. In K. Bottom, J. Diamond, P. Dunning, & I. Elliott (Eds.), *Handbook of teaching public administration* (pp. 178–187). Cheltenham, UK: Edward Elgar Publishing.

Lafton, T. (2016). Refleksjoner og handlinger i barnehagens møter med teknologi. Sosio-materielle teorier som optikk for (re)konstruksjoner av barnehagepraksiser [Reflections and actions in kindergarten encounters with technology. Socio-material theories as optics for (re)constructions of kindergarten practices]. Doctoral dissertation, University of Oslo.

Larrivee, B. (2000). Transforming teaching practice: Becoming the critically reflective teacher. *Reflective Practice*, 1(3), 293-307.

Loughran, J. (1996). *Developing reflective practice: Learning about teaching and learning through modelling*. London, UK: Falmer Press.

Loughran, J. J. (2000). Effective reflective practice. Paper presented at Making a Difference through Reflective Practices: Values and Actions Conference, University College of Worcester, July 2000.

Loughran, J. J. (2002). Effective reflective practice: In search of meaning in learning about teaching. *Journal of Teacher Education*, 53(1), 33-43.

Lubbe, W., & Botha, C. S. (2020). The dimensions of reflective practice: A teacher educator's and nurse educator's perspective. *Reflective Practice*, 21(3), 287–300. https://doi.org/10.1080/14623943.2020.1738369

Mac Suibhne, S. (2009). 'Wrestle to be the man philosophy wished to make you': Marcus Aurelius, reflective practitioner. *Reflective Practice*, 10(4), 429–436.

Maksimovic, J., & Osmanovic, J. (2018). Reflective practice as a changing factor of teaching quality. *Research in Pedagogy*, 8(2), 172–189.

Mann, S., & Walsh, S. (2013). RP or RIP: A critical perspective on reflective practice. *Applied Linguistics Review*, 4(2), 291–315. https://doi.org/10.1515/applirev-2013-0013

Matthews, B., & Ross, L. (2010). *Research methods: A practical guide for the social sciences*. Harlow, UK: Pearson Education.

McKay, E. A. (2008). Reflective practice: Doing, being and becoming a reflective practitioner. In L. Finlay & A. Bullman (Eds.), *Changing practice in health and social care* (pp. 100-114). London, UK: Sage.

Mezirow, J. (1990). *Fostering critical reflection in adulthood: A guide to transformative and emancipatory learning*. San Francisco, CA: Jossey-Bass.

Mezirow, J. (1991). *Transformative dimensions of adult learning*. San Francisco, CA: Jossey-Bass.

Mezirow, J. (1996). Contemporary paradigms of learning. *Adult Education Quarterly, 46*(3), 158–172

Mezirow, J. (Ed.). (2000). *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco, CA: Jossey-Bass.

Ministry of Education and Research (MER). (2012). Nasjonale retningslinjer for barnehagelærerutdanningen [National guidelines for kindergarten teacher education]. regjeringen.no.

Moxnes, A. R., & Osgood, J. (2018). Sticky stories from the classroom: From reflection to diffraction in early childhood teacher education. *Contemporary Issues in Early Childhood*, 19(3), 297-309. https://doi.org/10.1177/1463949118766662

Nguyen, H., & Baldauf Jr., R. (2010). Effective peer mentoring in EFL pre-service teacher's instructional practicum practice. *The Asian EFL Journal Quarterly*, 12(3), 40–61.

Parasuraman, A. (2000). Technology readiness index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research*, 2(4), 307-320.

Pollard, A., Anderson, J., Maddock, M., Swaffield, S., Warin, J., & Warmick, P. (2008). *Reflective teaching* (3rd ed.). London, UK: Continuum International Publishing Group.

Prunkl, C., & Whittlestone, J. (2020). Beyond near-and long-term: Towards a clearer account of research priorities in AI ethics and society. In *The 2020 AAAI/ACM Conference on AI for Ethics and Society*. https://arxiv.org/pdf/2001.04335.pdf

Quinn, F. M. (2000). Reflection and reflective practice. In C. Davies, L. Finlay, & A. Bullman (Eds.), *Changing practice in health and social care* (pp. 15-27). London, UK: Sage. (Original work published 1988)

Rubin, H. J., & Rubin, I. S. (1995). *Qualitative interviewing: The art of hearing data*. Thousand Oaks, CA: Sage.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Schön, D. A. (1987). *Educating the reflective practitioner*. San Francisco, CA: Jossey-Bass.

Sedaghat, S. (2023). Success through simplicity: What other artificial intelligence applications in medicine should learn from history and ChatGPT. *Annals of Biomedical Engineering*, 1-2.

Stanford d.school. (2023, February 21). Reflecting with AI: A tool to develop human intelligence. *Medium*. https://medium.com/stanford-d-school/reflecting-with-ai-a-tool-to-develop-human-intelligence-88cec86babf

Tomlinson, C. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). Alexandria, VA: ASCD.

Turing, A. M. (1950). Computing machinery and intelligence. *Mind*, 59(236), 433-460. https://doi.org/10.1093/mind/LIX.236.433

Treacy, D., & Gaunt, H. (2021). Promoting interconnections between reflective practice and collective creativity in higher arts education: The potential of engaging with a reflective matrix. *Reflective Practice*, 22(4), 488–500. https://doi.org/10.1080/14623943.2021.1923471

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157), 1124–1131.

Usher, R., Bryant, I., & Johnston, R. (1997). *Adult education and the postmodern challenge: Learning beyond the limits*. London, UK: Routledge.

Veletsianos, G. (2010). A definition of emerging technologies for education. In G. Veletsianos (Ed.), *Emerging technologies in distance education* (pp. 3-22). Edmonton, AB: Athabasca University Press. Retrieved from https://bit.ly/cPIPqd

Venkatesh, V., Thong, J. Y. L., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, 17(5), 328-376.

Winter, R. (2003). Buddhism and action research: Towards an appropriate model of inquiry for the caring professions. *Educational Action Research*, 11(1), 141–160. https://doi.org/10.1080/09650790300200208

World Economic Forum. (2024). *Shaping the future of learning: The role of AI in Education 4.0*. Available from https://www.weforum.org/reports/shaping-the-future-of-learning-the-role-of-ai-in-education-4-0

Weiser, M. (1991). The computer for the 21st century. *Scientific American*, 265(3), 94-104. Available from https://www.scientificamerican.com/article/the-computer-for-the-21st-century/

Zhang, B., & Dafoe, A. (2019). Artificial intelligence: American attitudes and trends. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3312874

Zohuri, B., & Mossavar-Rahmani, F. (2024). The symbiotic evolution: Artificial Intelligence (AI) enhancing Human Intelligence (HI) an innovative technology collaboration and synergy. *Journal of Materials Science and Applied Engineering*, 3(1), 1-5.

Acknowledgments

I would like to express my sincere gratitude to my supervisor, Emanuele Bardone, for his dedication and guidance towards the writing of this thesis from start to finish. I would also like to express my happiness and satisfaction in having such kind and intelligent classmates for their insightful feedback, interesting discussions, and friendship during this journey. I would also like to thank Leticia Britos Cavagnaro of Standford D University who allowed me to use the Riff tool as part of my research of AI in Reflective Practice. Lastly, I would like to thank all my family and friends who have helped me in recent months during this phase of my life, your encouragement, kindness, and patience are reflected in this work.

Author's declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Brian Lynam

31/05/2024

Appendix 1.

Consent Form

An exploration on the transformative use of Artificial Intelligence as a reflection tool, through the experience and perspectives of trainee teachers

I agree to participate in the research project titled, 'An exploration on the transformative use of Artificial Intelligence as a reflection tool, through the experience and perspectives of trainee teachers, conducted by Brian Lynam, who has discussed the research project with me.

I have had the opportunity to ask questions about this research and I have received satisfactory answers. I understand the general purposes, risks and methods of this research.

I consent to participate in the research project and the following has been explained to me:

- the research may not be of direct benefit to me
- my participation is completely voluntary
- my right to withdraw from the study at any time without any implications to me
- the risks including any possible inconvenience, discomfort or harm as a consequence of my participation in the research project
- what I am expected and required to do
- I am able to request a copy of the research findings and reports
- security and confidentiality of my personal information

In addition, I consent to:

- audio recording of any part of or all research activities
- publication of results from this study on the condition that my identify will not be revealed.

Name: _____ (please print)

Signature: _____

Date: _____

Appendix 2.

Appendix 2. Form for the graduation thesis (bachelor's thesis / master's thesis) project

Student (Brian Lynam, Master of Educational Technology, 2023. Brian.lynam@ut.ee
Preliminary title of the thesis and volume in ECTS credits (for a master's thesis, the field of research according to CERCS) - *An exploration on the transformative use of Artificial Intelligence as a reflection tool, through the experiences and perspectives of trainee teachers*
Supervisor(s) (given name, surname, degree, position, contact information) Emanuele Bardone, Programme Director of Educational Technology
Justification of the choice of topic and the research problem (backed by research and correctly referenced) – refer to Thesis section 2.7
Objective of the thesis (one sentence) – To explore the transformative use of Artificial Intelligence as a reflection tool, though the experiences and perspectives of trainee teachers.
Hypothesis/hypotheses and/or research questions of the thesis What are the experiences and perspectives of trainee teachers regarding the transformative use of Artificial Intelligence as a reflection tool?
Research methods: sample, data collection, data analysis – Qualitative Interviews
Thesis timeline (estimated allocation of time by months) - 9 months
Sources used for compiling the project (formatted according to the graduation thesis requirements) List of references on thesis, APA style.
Signature of the student: (signed digitally) Brian Lynam
Signature of the supervisor: (signed digitally)

Non-exclusive licence to reproduce the thesis and make the thesis public.

I, Brian Lynam,

1. grant the University of Tartu a free permit (non-exclusive licence) to

reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright, my thesis

An exploration on the transformative use of Artificial Intelligence as a reflection tool, through the experiences and perspectives of trainee teachers

supervised by Emanuel Bardone

2. I grant the University of Tartu a permit to make the thesis specified in point 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 4.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in points 1 and 2.

4. I confirm that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

Brian Lynam

31/05/2024